REMARKS

By this Amendment, claims 1 and 9 are amended, and claims 38-39 are added. Claims 3-8 and 10-37 remain in the application. Thus, claims 1 and 3-39 are active in the application. Reexamination and reconsideration of the application are respectfully requested.

The Applicants thank the Examiner for kindly indicating, in item 7 on page 9 of the Office Action, that claims 10-37 are allowable.

In item 7 on page 9 of the July 19, 2004 Office Action, claim 2 was indicated to be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claim.

In view of the Examiner's assertion that claim 2 would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claim, claim 1 was amended in the October 19, 2004 Amendment to include the limitations of claim 2. Accordingly, claim 2 was cancelled. Claim 9 was amended similar to claim 1 in the October 19, 2004 in order to include the limitations originally recited in claim 2.

However, in item 1 of the April 7, 2005 Office Action, the previously indicated allowability of claim 2 was withdrawn. In view of the withdrawal of the allowability of claim 2, the limitations originally recited in cancelled claim 2 have been deleted from claim 1 and are now recited in new dependent claim 38. Similarly, in view of the withdrawal of the allowability of claim 2, the limitations of claim 2 have been deleted from claim 9 and are now recited in new dependent claim 39.

In item 3 on page 2 of the Office Action, claims 1 and 3-6 were rejected under 35 U.S.C. § 102(e) as being anticipated by Clatanoff et al. (U.S. 5,519,451). In item 4 on page 4 of the Office Action, claims 1 and 3-8 were rejected under 35 U.S.C. § 102(e) as being anticipated by Shin et al. (U.S. 6,630,961). Further, in item 6 on page 8 of the Office Action, claim 9 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Shin et al.

Without intending to acquiesce to these rejections, independent claims 1 and 9 have each been amended in order to more clearly illustrate the marked differences between the present invention and the applied references.

The present invention provides a deinterlacing apparatus and method for converting an interlaced image into a progressive image. As described beginning at line 4 on page 32 of the substitute specification (beginning at line 10 on page 31 of the original specification) and as illustrated in Figure 1, the deinterlacing apparatus of the present invention stores an inputted interlaced image in a frame memory 101. This section of the specification describes a case where fields #n-2 to #n+1 as shown in Figure 2, i.e., four fields, are stored, and the field #n is subjected to deinterlacing.

In this case, a VT filter unit 102 of the deinterlacing apparatus receives data of the fields #n-1, #n and #n+1. Then, when an interpolation pixel in a position "k" as shown in Figure 2 is to be generated, pixels which are adjacent to the position "k" are subjected to the filtering process. In this case, pixels "a"-"j" are subjected to the filtering process.

A difference operation unit 104 of the deinterlacing apparatus receives data of two frames including the field #n (deinterlacing target), i.e., frames #m-1 and #m (fields #n-2 to #n+1). The difference operation unit 104 calculates a difference between the frames #m-1 and #m so as to obtain the quantity of motion of the frame #n. Difference values between positionally corresponding pixels in these frames are obtained, and the sum of the respective absolute values of the difference values is obtained as the quantity of motion. Then, the obtained result is outputted to a filter coefficient setting unit 103. The filter coefficient setting unit 103 decides (changes) a filter coefficient of a filter used in the filtering process based on the sum of the absolute values of the differences which are inputted from the difference operation unit 104.

Accordingly, the present invention provides a deinterlacing method which comprises performing a filtering process to pixels of at least one of three fields, a deinterlacing target field to be subjected to a deinterlacing process and forward and backward fields of the deinterlacing target field within the interlaced image, so as to generate an interpolation pixel for the deinterlacing target field, and measuring a quantity of motion of the deinterlacing target field. The deinterlacing method of the present invention also comprises <u>changing a filter coefficient of a filter used in the filtering process based on the quantity of the motion measured in the measuring of the quantity of motion</u>.

The deinterlacing apparatus of the present invention comprises a frame memory for storing the interlaced image, and a filter unit for receiving, from the frame memory, a deinterlacing target field to be subjected to a deinterlacing process and one or both of forward and backward fields of the deinterlacing target field within the interlaced image, and performing a filtering process to pixels of at least one of the received fields so as to generate an interpolation pixel for the deinterlacing target field. Further, the deinterlacing apparatus of the present invention comprises a difference operation unit for measuring a quantity of motion of the deinterlacing target field, and a filter coefficient setting unit for changing a filter coefficient of the filter unit based on the quantity of the motion measured by the difference operation unit.

Claim 1 recites the deinterlacing method of the present invention, and claim 9 recites the deinterlacing apparatus of the present invention. The method of claim 1 and the apparatus of claim 9 are each recited as generating an interpolation pixel for the target field by performing a filtering process to pixels of at least one of three fields, and changing the filter coefficient of a filter (filter unit) used in the filtering process based on the measured quantity of motion of the target field.

In contrast to claims 1 and 9, as indicated by the Examiner, Clatanoff et al. and Shin et al. disclose a technique of detecting a quantity of motion of a target field from the target field and a field obtained by delaying the target field for several fields, generating a motion signal by performing a filtering process to this quantity of motion, and generating an interpolation pixel for the target field by using the generated motion signal.

However, for the reasons described below, neither Clatanoff et al. nor Shin et al. disclose or suggest generating an interpolation pixel for the target field by performing a filtering process to pixels of at least one of three fields, and changing the filter coefficient of a filter used in the filtering process based on the measured quantity of motion of the target field, as recited in claims 1 and 9.

Clatanoff et al. discloses a method of processing video data to produce a progressively scanned signal from an input of interlaced video. With reference to Figure 1, which illustrates two scan-line video processors SVP#1 and SVP#2, Clatanoff et al. discloses that a luminance signal Y travels to SVP#1 along path 10, and travels unchanged to SVP#2 along path 12. The original luminance signal Y also travels along

path 14 to a Field DL 16, which delays the luminance signal by one field. The once-delayed luminance signal is then sent to the SVP#2 along path 18, and to a one-line horizontal delay 1H 20 and another Field DL 22, whereupon a twice-delayed signal is then sent to the SVP#1. The SVP#1 produces the following three signals. The first signal is k' at path 26 which is delayed one field and is reprocessed by the SVP #1 to produce a motion signal k at path 28. The motion signal k is the second signal produced by the SVP#1. The third signal produced by the SVP#1 is edgee information 4 that is sent to the SVP#2 along path 30 (see Column 2, lines 40-52).

The upper dashed-line box of Figure 2 is the SVP#1 of Figure 1 of Clatanoff et al. On page 2 of the Office Action, the Examiner contends that the median filter 45 of the SVP#1 of Clatanoff et al. performs a filtering process to pixels of at least one of three fields. Contrary to the Examiner's assertion, the median filter 45 does not perform a filtering process to pixels of at least one of three fields to generate an interpolation pixel for a deinterlacing target field. Instead, as specifically disclosed in Column 3, lines 34-49 of Clatanoff et al., the median filter 45 is used for eliminating noises from the motion signal k.

Accordingly, the median filter 45 does not generate an interpolation pixel for a target field, as recited in claims 1 and 9. Instead, Clatanoff et al. discloses that an interpolation pixel for the target field is generated by combining the edge information and the motion signal (see Abstract). Accordingly, as described above, Clatanoff et al. discloses that the target field is not generated by a filter.

Therefore, Clatanoff et al. clearly does not disclose or suggest <u>generating an interpolation pixel for the target field by performing a filtering process</u> to pixels of at least one of three fields, and <u>changing the filter coefficient of a filter used in the filtering process based on the measured quantity of motion of the target field</u>, as recited in claims 1 and 9.

Accordingly, claim 1 is clearly not anticipated by Clatanoff et al. since Clatanoff et al. does not disclose each and every limitation of claim 1.

Shin et al. discloses a deinterlacing device which includes a median filter 600. On page 5 of the Office Action, the Examiner contends that the median filter 600 of Shin et al. performs a filtering process to pixels of at least one of three fields.

However, contrary to the Examiner's assertion, the median filter 600 does not does not perform a filtering process to pixels of at least one of three fields to generate an interpolation pixel for a deinterlacing target field. Instead, as specifically disclosed in Column 5, line 52 to Column 6, line 17, the median filter 600 is used for eliminating noise components from a motion signal outputted from a motion determination part 200. Similar to Clatanoff et al., the median filter 600 of Shin et al. does not perform a filtering process to pixels of at least one of three fields to generate an interpolation pixel for a deinterlacing target field, as recited in claims 1 and 9.

Instead, Shin et al. discloses that spatial interpolators 300 and 400 generate interpolation values, and a soft switch 500 selects an interpolation value based on a motion signal. Accordingly, Shin et al. also clearly does not disclose or suggest performing a filtering process to pixels of at least one of three fields to generate an interpolation pixel for a deinterlacing target field, and changing the filter coefficient of the filter used in the filtering process based on the measured quantity of motion of the target field, as recited in claims 1 and 9.

Therefore, similar to Clatanoff et al., Shin et al. clearly does not disclose or suggest each and every limitation of claims 1 and 9.

Accordingly, claim 1 is clearly not anticipated by Shin et al., and claim 9 is clearly not unpatentable over Shin et al. since Shin et al. fails to disclose or suggest each and every limitation of claims 1 and 9.

Furthermore, because of the clear distinctions discussed above, no obvious combination of Clatanoff et al. and Shin et al. would result in the inventions of claims 1 and 9 since Clatanoff et al. and Shin et al., either individually or in combination, clearly fail to disclose or suggest each and every limitation of claims 1 and 9.

Moreover, it is submitted that the distinctions are such that a person having ordinary skill in the art at the time the invention was made would not have been motivated to modify Clatanoff et al. and Shin et al. in such as manner as to result in, or otherwise render obvious, the present invention as recited in claims 1 and 9. Therefore, it is submitted that the claims 1 and 9, as well as claims 2-8 and 38-39 which depend therefrom, are clearly allowable over the prior art as applied by the Examiner.

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice thereof is respectfully solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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